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PEAT BRIQUETTES AS BLAST-FURNACE FUEL

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The use of peat in smelting pig iron is not new. Even at the time when charcoal was the chief fuel in blast-furnace smelting, peat was used both as an admixture to it and independently.

The USSR has tremendous deposits of peat, exceeding those of all the rest of the world. Nevertheless, many regions of the country have brought in blast-furnace fuel from a distance while they had their own peat deposits. Peat is free of harmful admixtures such as sulfur and phosphorus, a fact which makes it particularly important for blast-furnace smelting. Use of peat produces gas with a high calorific value which is suitable for industrial and domestic use and from which valuable constituents may be extracted.

For these reasons, the possibility of introducing peat into blast-furnace charges was considered, and in this connection a number of experimental blast-furnace melts were made. The experimental melts did not give entirely satisfactory results but they did show that peat coke is completely suitable for blast-furnace smelting and that air-dried peat under specific conditions can be used in furnaces up to 20 meters in height. In this case, however, the furnace productivity is decreased because of the low weight per volume of the peat.

The experiments were not enough. Before peat could be used profitably in blast-furnace smelting, its technological value had to be increased, i.e., the carbon content had to be increased, the moisture content decreased, and the toughness intensified. The cost of peat had to be brought to a level comparable to the costs of other types of blast-furnace fuel, and the labor expenditure connected with its production had to be reduced.

The first phase of the problem is to be solved by a concentration process, briquetting. The result of this is a product which is greatly different from the original substance: its weight by volume is considerably higher, its moisture content is comparatively low and constant, its carbon content is higher, and its

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toughness, while not high, is higher than that of air-dried peat (which withstood experimental smelting). In all these qualities the peat briquette satisfies the requirements of blast-furnace smelting better than air-dried peat.

As for costs in the development of briquetting, based on milled peat (or other highly mechanized processes of peat production), labor expenditures in the preparation of peat briquettes do not exceed those required for the production of an equivalent amount of coal.

Since the peat briquette has greater weight by volume, it permits better utilization of blast-furnace capacity than does air-dried peat and is therefore superior to the latter. A very valuable high-calorie gas is produced when the peat briquette is used; this constitutes its superiority to bituminous coal coke.

The first experiments with the ordinary peat briquette indicate its unsuitability for blast-furnace smelting because in dry distillation the briquette either crumbles to powder or results in a very brittle product. The thermomechanical qualities of the peat briquette are very low and make it unsuitable for blast-furnace smelting.

This is explained by the fact that peat does not have caking properties. Lumps of peat behave like wood in dry distillation. They lose in weight and volume and are converted into carbon, lumps of which are similar to the original but smaller. Although lumps of wood yield relatively tough charcoal in dry distillation, a briquette of sawdust does not yield lump carbon under these circumstances. Peat behaves precisely the same way. Peat particles do not give a lump product, but the briquette [made of them] crumbles into powder.

Research at the Moscow Peat Institute established that the thermomechanical properties of the peat briquette can be considerably increased by the introduction of a special method (rezhim) of briquetting, resulting in a different degree of toughness of the raw briquette. Any peat can be used for such a briquette.

The raw briquette has a weight by volume of not less than 750 kilograms per cubic meter, with a resistance to pressure of more than 350 kilograms per square centimeter and a resistance to disintegration through friction which is higher than in the case of bituminous coal coke.

The product which results from coking such a briquette has a resistance to pressure of more than 130 kilograms per square centimeter, i.e., twice as great as ordinary peat coke, and a 5-10 percent resistance to disintegration through friction. It has a weight by volume of 600 kilograms per cubic meter and a porosity of nearly 50 percent.

Such a briquette is suitable for blast-furnace smelting and for coking, and no binder material is required in preparing it. No valuable constituents of the peat are lost. In its toughness this briquette is entirely suitable for smelting even in modern high blast furnaces. In addition to its indicated advantages, the peat briquette is very valuable from the standpoint of the requirements of the blast-furnace process. The briquette ash content depends on the peat ash content. Briquettes with a low ash content may be obtained by utilizing peat with a low ash content. In some cases an increased ash content in the peat may be desirable if it is lime ash. This can reduce flux consumption in blast-furnace smelting.

The technology of preparing a briquette of increased toughness has been adequately clarified. Industrial preparation of it requires introduction of a regulated method of briquetting but this is scarcely reflected in the cost of the briquette.

The peat briquette may be used raw in blast-furnace smelting or it may be used in the form of coke or semicoke, but the design of ovens for coking the briquette and the technology of the process must still be worked out. A peat briquette can be obtained also by briquetting peat particles after coking them, but this process requires the use of binder materials, seems more complicated, and results in a more brittle product.

The peat briquette is definitely a good blast-furnace fuel since it possesses all the virtues of air-dried peat and some of those of peat coke, but lacks their defects. It can be used in blast-furnace smelting either with or without admixture of other fuels.

There are numerous ways of utilizing the peat briquette in blast-furnace smelting. Use of the raw briquette arouses chief interest. The blast furnace has adequate heat resources to coke the briquette during the smelting itself. This is shown by calculating the heat balance (balans) of smelting and from the experience of blast-furnace operation on raw fuel, particularly on air-dried peat, the coking of which requires considerably more heat than does coking of the peat briquette. Use of the raw briquette eliminates the necessity of large capital expenditures on the construction of coking ovens. and improves the gas balance of blast-furnace smelting. The yield of coke from coking in a blast furnace is 20 to 25 percent higher than from a coke oven.

The peat briquette has only two thirds the calorific value of bituminous coal coke (by weight), yet because of its great weight by volume use of it does not interfere with utilization of blast-furnace capacity.

The peat briquette can in a number of cases replace bituminous coal coke or be used as an admixture with it. Even a small admixture of briquette improves the coke balance and is favorably reflected in the results of blast-furnace smelting by an improvement in the quality of the metal and an increase in the calorific value of the gas.

The use of peat in the production of high-grade pig iron necessary for the construction of instruments, apparatus, electrical machinery, etc., is of great interest.

Blast furnaces which use a coke charge to smelt ores free of sulfur and phosphorus do not produce the required product since the coke introduces deleterious admixtures into the charge. Therefore, proposals for providing industry with high-grade pig iron boil down to a plan for the restoration of charcoal blast-furnace smelting.

The same results can be obtained by organizing blast-furnace smelting for pure ores with peat briquettes as fuel. For quality, the peat briquette can replace charcoal entirely. The only difference is that considerably greater productivity is achieved with the briquette than with charcoal because of the greater compactness of the former. The cost of producing high-grade pig iron is considerably less when a peat briquette is used than when charcoal is used.

Providing peat briquettes for available charcoal-fired blast furnaces the capacity of which is not large seems a simple matter. The ordinary peat-briquetting plant can produce 50,000 to 100,000 tons of peat briquettes /per year?/.

The peat briquette can be used also in blast-furnace smelting as complete or partial replacement for coke in the small furnaces of the Urals. There are more than 20 blast furnaces the useful height of which does not exceed 20 meters. These furnaces can be assured supplies of peat briquettes by the construction of peat-briquetting plants at deposits adjacent to the furnaces. Experimental smeltings have indicated that the peat briquette is definitely suitable in mechanical toughness for furnaces of such a height.

Tula blast furnaces, where peat experimental smeltings were carried on, are operating at present on coke transported from a distance. Peat briquettes can successfully take the place of this coke.

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When a blast furnace operates on peat briquettes, the blast-furnace gas formed has a high calorific value, approximately 1,500 calories per cubic meter, or 150 percent of that of ordinary blast-furnace gas. This gas contains very valuable ingredients which can be extracted and utilized. After suitable processing, the calorific value of the gas can be raised to 2,500 to 3,000 calories per cubic meter. Gas-blast furnace combines could be established to supply large municipal centers with gas and the adjacent industrial regions with pig iron.

The establishment of gas-blast furnace combines in regions with considerable peat and iron ore deposits (even small deposits of poor ore) is entirely justifiable. Such combines could be set up in Leningrad, Kiev, Minsk, Novosibirsk, Sverdlovsk, and a number of other cities.

The use of the peat briquette in blast-furnace production will bring about a sharp increase in blast-furnace fuel supplies, an increase in the smelting of high-grade pig iron, development of metallurgy in regions not having their own deposits of coking coal, the working of small deposits of ores not being exploited at present, a decrease in the transport of coal from a distance, and the development of gasification and the chemical industries on the basis of peat blast-furnace gas.

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